PATENT APPLICATION

RESPONSE UNDER 37 CFR §1.116
EXPEDITED PROCEDURE
TECHNOLOGY CENTER ART UNIT 1763

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

response

#16 NE
7/17/03
MWS

In re the Application of

Masashi UEDA et al.

Application No.: 09/830,879

Filed: May 2, 2001

Group Art Unit: 1763

Examiner: P. Hassanzadeh

Docket No.: 109426

For: INTERNAL ELECTRODE TYPE PLASMA PROCESSING APPARATUS AND PLASMA PROCESSING METHOD

REQUEST FOR RECONSIDERATION AFTER FINAL REJECTION

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In reply to the April 16, 2003 Final Office Action, and further to the April 11, 2003 personal interview between Applicants' representative and Examiner Hassanzadeh, reconsideration of the rejections is respectfully requested in light of the following remarks.

Claims 1-18 are pending. Claims 8-18 are withdrawn from consideration as being drawn to non-elected Group and Species, there being no generic or linking claim. Rejoinder of claims 1-18 is respectfully requested.

Applicants appreciate the courtesies extended to Applicants' representative by Examiner Hassanzadeh during the April 11, 2003 interview. The points discussed during the interview are incorporated in the remarks below and constitute Applicants' record of the interview.

I. Claim 1 Satisfies the Requirements under 35 U.S.C. §112, second paragraph

Claim 1 is rejected under 35 U.S.C. §112, second paragraph, as being indefinite. Claim 1 was amended in the March 21, 2003 Amendment to obviate this rejection. Specifically, "excitation wavelength" was replaced with --a wavelength of a supplied high frequency power--.

As explained in the specification, the length necessary for a U-shape electrode to generate a standing wave is provided by equation (1) on page 15. The length of the electrode corresponds to about the half-length of the wire length before being bent back. For a frequency of f = 120 MHz of the supplied high frequency power, for example, the electrode length based on the wavelength becomes $L1 = c / 2f = 2.998 \cdot 10^8$ m/s / [2 $(1.2 \cdot 10^8 s^{-1})$] = 1.25 m (where c is the speed of light in a vacuum). Withdrawal of the rejection under 35 U.S.C. §112, second paragraph is respectfully requested.

II. Claims 1-7 Define Patentable Subject Matter

The Final Office Action rejects claims 1-3, 5 and 6 under 35 U.S.C. §103(a) over U.S. Patent 5,558,718 to Leung in view of Japanese Patent JP 08-299785A to Nawata *et al.* (Nawata). The Final Office Action further rejects claims 1-7 under 35 U.S.C. §103(a) over U.S. Patent 5,795,492 to Kinoshita *et al.* (Kinoshita) in view of Leung and Nawata. These rejections are respectfully traversed.

Applicants' claims recite features directed to a plasma processing apparatus based on plasma chemical vapor deposition (CVD) using an inductive coupled electrode for uniformly depositing an amorphous thin film onto a large-area rectangular substrate to make a solar cell. According to Applicants' claimed features, the electrode is formed by bending the conductive line-shaped wire back at its central portion to make a substantially U-shaped member. The electrodes having the U-shape are arranged in a predetermined pattern in the chamber based on the substrate conveyed in the chamber.

The predetermined high frequency power is supplied to the electrodes from a high frequency power source in order to produce a standing wave with the predetermined pattern along each of the electrodes. As explained above, the electrode length is based on the frequency of the high frequency power supply.

Leung, Nawata and Kinoshita, alone or in combination, do not teach or suggest an inductive coupled electrode in a plasma processing apparatus for generating plasma in a vacuum processing chamber, the plasma processing apparatus wherein the electrode is formed by a conductive line-shaped member whose total length is substantially equal to a wavelength of a supplied high frequency power, and is formed so that, one end of the electrode is grounded and another end thereof is connected to a high frequency power source for supplying the high frequency power, and a standing wave of one wavelength is produced along the electrode when the high frequency power source supplies the high frequency power to the electrode, and a node of the standing wave produced along the electrode is formed at a central portion of the electrode, and an antinode of the standing wave is formed on both portions respectively corresponding to a half portion of the electrode, which exist at both sides of the center point, as recited in claim 1.

Instead, Leung discloses a vacuum chamber having a pulsed plasma source 10. In particular, Leung teaches the pulse plasma source 10 as having a partial-coil shape arranged around the target object 11 placed inside the chamber walls 14. A pulse current is supplied into the pulsed plasma source 10 from the RF pulse circuit to expose the target object 11 to the plasma in a pulse mode. See col. 5, lines 2-40 and Fig. 2C of Leung. Also, Leung provides for independent adjustment of pulse width and repetition rate. The RF generator 23 is tuned so that voltage and current are in phase. See col. 6, lines 37-50 and Figs. 4A-4C of Leung. There is neither any relationship between the length of the RF antenna 30 and the pulse rate, nor a node at the central location of the electrode. Thus, Leung teaches away from Applicants' claimed features.

Because the pulse plasma source 10 shown in Leung is not grounded, the Final Office Action also applies Nawata as an additional reference. Applicants assert that Nawata fails to compensate for the deficiencies of Leung for Applicants' claim 1, and also does not disclose the additional features in Applicants' dependent claims 2, 3, 5 and 6.

Nawata discloses a discharge reactor. The Office Action asserts that the plasma processing apparatus of Nawata has a plurality of electrodes, that these electrodes are connected to the RF power source, and that the ends of the electrodes are grounded. Applicants respectfully disagree, and assert that the discharge reactor in Nawata merely shows a parallel-planar electrode structure.

Nawata does not compensate for the deficiencies of Leung outlined above for claim 1. Nor does Nawata teach, disclose or suggest the additional features recited in claims 2, 3, 5 and 6. Instead, Nawata discloses a parallel-planar electrode structure in a discharge reactor. See the Abstract of Nawata.

Further, Kinoshita discloses a dry process system having a chamber 1 with reaction gas 4. In particular, Kinoshita teaches at least one pair of planar electrodes 21, 22 arranged inside the chamber 1 in parallel. A substrate 3 is loaded on the electrodes that are supplied with an alternating current power source 6 through a predetermined electric element, *e.g.*, a blocking capacitor 7 and a means for applying a magnetic field shown as one or more magnetic field lines 11. See col. 5, lines 46-62 and Figs. 1-11 of Kinoshita. Plasma is generated by magnetron discharge 13, and can be produced by a direct power source. See col. 6, lines 47-67 and col. 8, lines 53-62 of Kinoshita, thereby teaching away from Applicants' claimed features.

Kinoshita also provides a mean free path for electrons. See col. 10, lines 23-56 of Kinoshita. Such teaching is completely non-analogous to the conductive line-shaped member length being substantially equal to the supplied high frequency power wavelength, as recited

in Applicants' claims. Also, Kinoshita shows a structure forming the layered parallel-planar electrodes without providing for the recited features of Applicants' claims.

Also, Leung and Nawata do not compensate for the deficiencies of Kinoshita outlined above. Instead, Leung discloses pulsed ion implantation, as described above. See col. 3, lines 48-67 of Leung. Further, Nawata teaches planar electrodes, which fails to provide any suggestion for Applicants' claimed features.

Further, there is no motivation to combine features related to the pulsed plasma vacuum chamber of Leung with the discharge reactor of Nawata, or to combine features related to the dry process discharge of Kinoshita with the vacuum chamber of Leung and the discharge reactor of Nawata. Nor has the Office Action established sufficient motivation or a *prima facie* case of obviousness. Even assuming that motivation to combine the applied references is established, the combination fails to teach or suggest Applicants' claimed features.

A *prima facie* case of obviousness for a §103 rejection requires satisfaction of three basic criteria: there must be some suggestion or motivation either in the references or knowledge generally available to modify the references or combine reference teachings, a reasonable expectation of success, and the references must teach or suggest all the claim limitations. See MPEP §706.02(j).

For at least these reasons, Applicants respectfully assert that the pending independent claim is now patentable over the applied references. The dependent claims are likewise patentable over the applied references for at least the reasons discussed as well as for the additional features they recite. Consequently, all the claims are in condition for allowance. Thus, Applicants respectfully request that the rejections under 35 U.S.C. §103 be withdrawn.

III. Conclusion

In view of the foregoing amendments and remarks, Applicants respectfully submit that this application is in condition for allowance. Favorable consideration and prompt allowance are earnestly solicited.

Should the Examiner believe that anything further is desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact Applicants' undersigned representative at the telephone number listed below.

Respectfully submitted,

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